White Sands Test Facility

Alternative Energy Generation to Support Groundwater Remediation

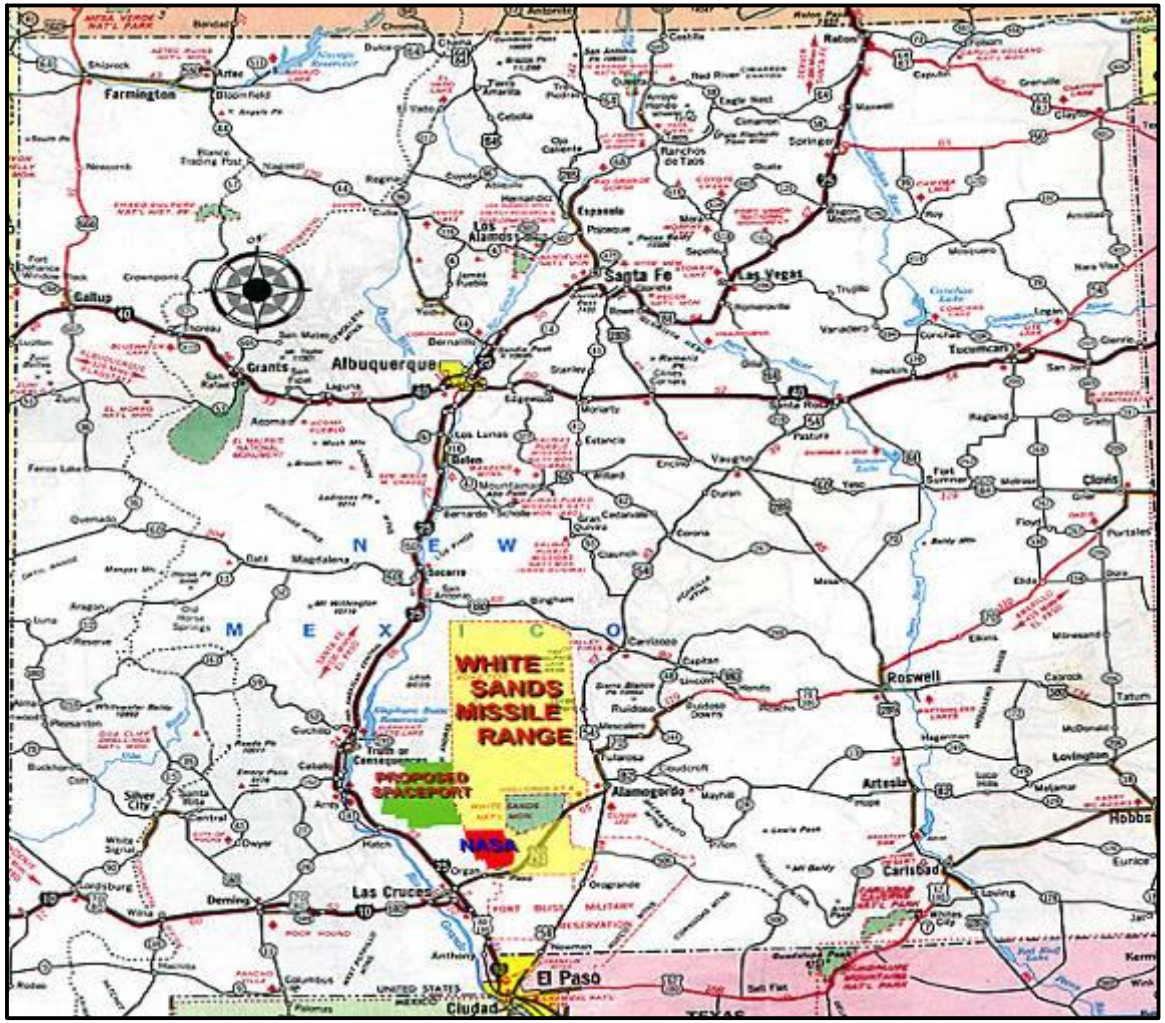
Holger Fischer

Engineering Office Chief

NASA White Sands Test Facility

- Constructed in 1962-64 to Support Apollo Project
- Occupies 28 Square Miles of the SW Corner of WSMR

NASA White Sands Test Facility



Overview

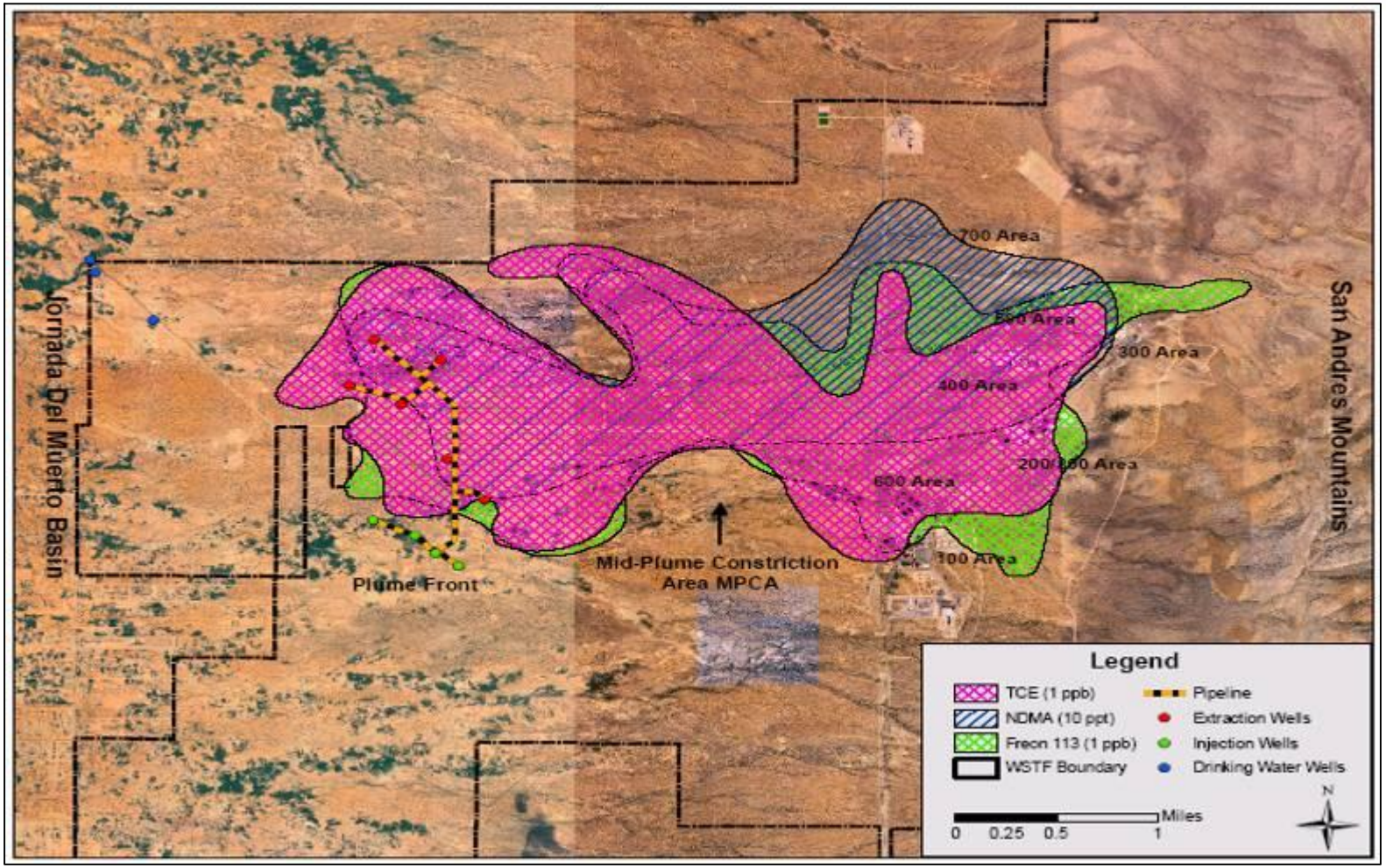
Plumefront Treatment System

- Historic operations and practices during the 1960's to early 1980's resulted in chemicals in the groundwater
  - Rocket Propulsion system testing programs:
    - N–Nitrosodimethylamine (NDMA)
    - Dimethylnitramine (DMN)
  - Cleaning Operations (tank leakages):
    - Trichloroethene (TCE)
    - Tetrachloroethene (PCE)
    - Freons (11, 21, and 113)

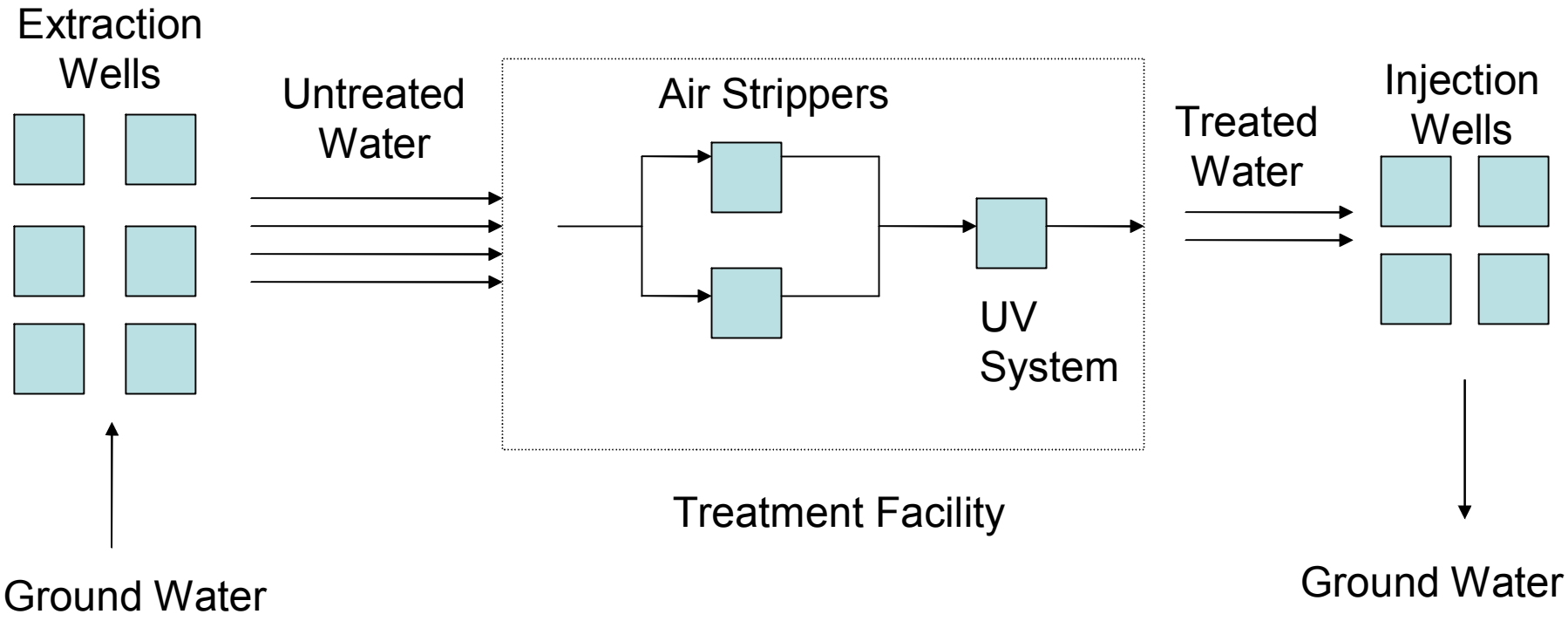
Plumefront Treatment System

- Groundwater Treatment System Purpose
  - Stop westward movement of the plume
  - Protect drinking water and irrigation wells
    - Treat chemicals in the groundwater
    - Using proven technologies
      - Cleaning chemicals are air stripped
      - NDMA and DMN are broken down using UV Photolysis
    - Return (inject) the treated water to the aquifer

Plumefront Remediation System



Plumefront Remediation System



Plumefront Remediation System Air Strippers

Plumefront Remediation System

- VOCs including TCE, PCE, Freon 113, Freon 21, and Freon 11 are air stripped and released to the surrounding air where they are broken down by normal processes
  - Validation test data demonstrated the total emission rate is 0.3 lb/h (1.33 tons/year).
  - For comparison, some industrial processes are permitted release tons per day of these compounds.
  - VOC emissions are ~ 8 times lower than the level required to notify NMED of a new emission source. NMED determined that no permit is required.

Plumefront Remediation System 250 kW UV Reactor

Plumefront Remediation System

- NDMA and DMN are oxidized to acceptable by-products by UV Photolysis.
- The UV reactor contains twelve 30 kW lamps (nominal operation at 20 kW).
- Lamps emit UV light into the contaminated water stream between 200 and 250 nm.

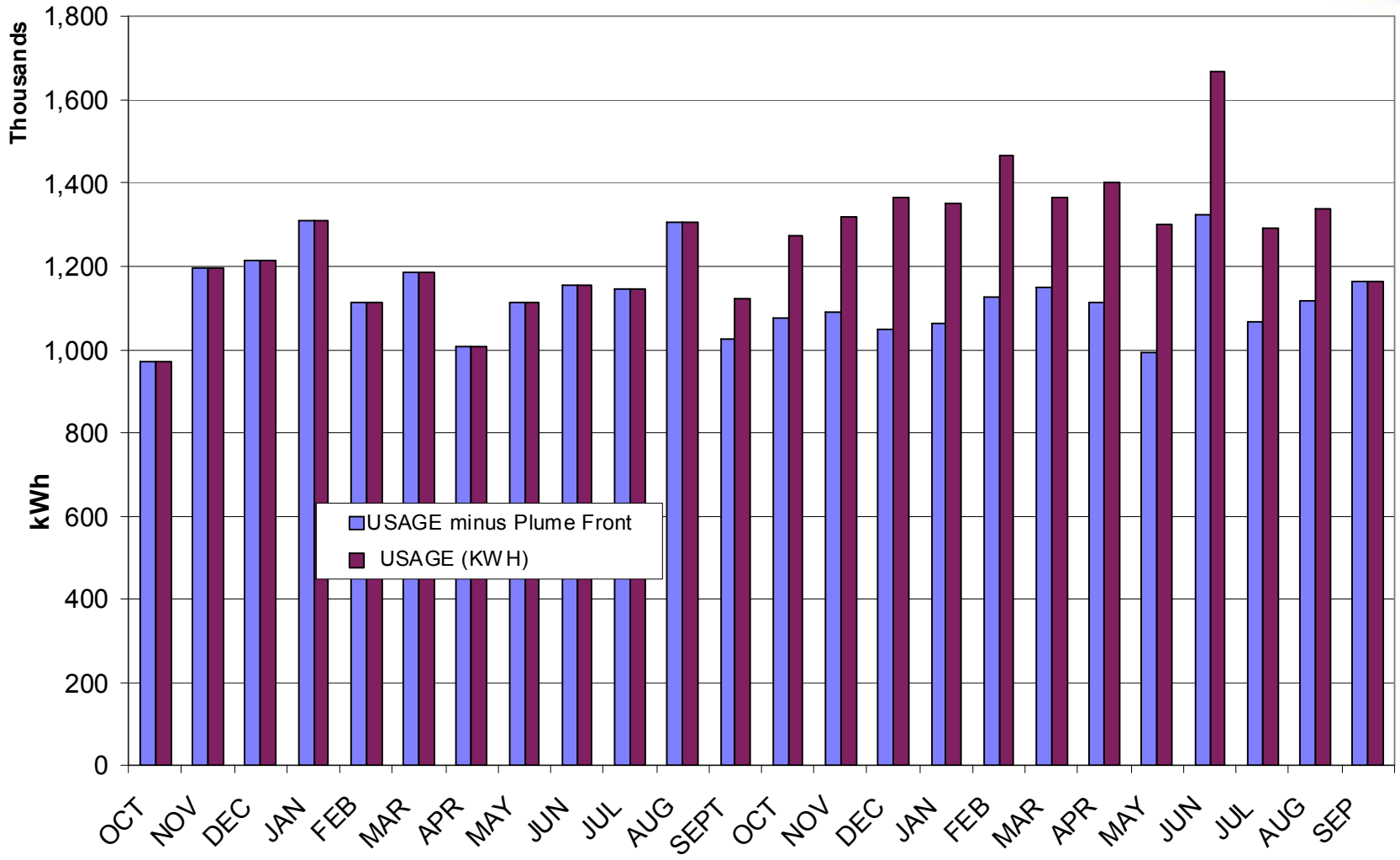
Plumefront Remediation System

Post treatment photos of UV Reactor Internals at Building 650 (10/19/2004)

Plumefront Remediation System

- Energy costs over the life of the groundwater cleanup at WSTF are expected to approach $100M for 24/7 operations and an estimated 60 years run time (FY05 estimate assumes a stable power cost).
- Today's demand is > 500 kW with only the Plume Front System online.
- Once the complete Remediation System is activated (Plume Front and Mid Plume) the systems will use ~ 1 MW.

Electrical Usage



Electrical Usage

- Not counting the Groundwater Remediation systems, WSTF has a 24/7 nominal demand exceeding 1.5 MW with daytime peaks over 2.5 MW.
- WSTF has several tenants and the combined nominal demand is currently 7 MW.

Electrical Usage

- The El Paso Electric Company (EPEC) transformer servicing the WSTF Industrial Complex has capacity of 11 MW.
- In June 2006, the combined electrical peak load reached 11MW.
- One tenant is planning to double their utility load by 2009, which is going to cause a problem with our current configuration.

Looking into the Future

- WSTF has a Class 5 wind located on the mountain range east of the facility (Class 5 out of 7 is excellent)
- Quartzite Mountain is able to support fourteen 1.5+ MW wind turbines. Access is a problem.
- Feasibility was performed to use wind energy to supplement commercial power.
  - Three turbines could supply 99% of needed energy for the Remediation Station.
  - At present, we are looking options to use renewable energy to power WSTF and even WSTF Industrial Area.

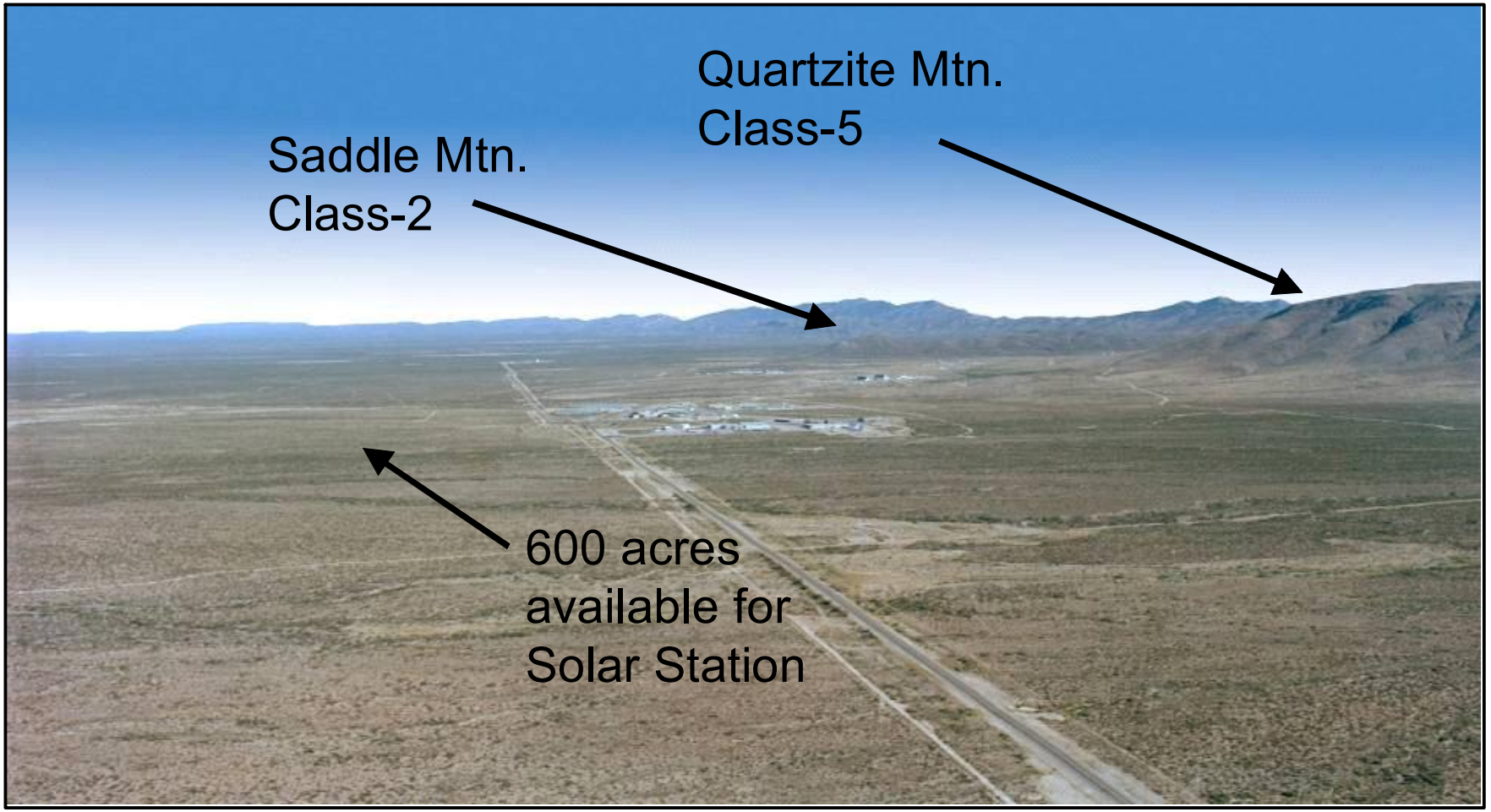
Looking into the Future Quartzite Mountain Tower

Looking into the Future Road for Access (Challenge)

Looking into the Future

- WSTF also has a Class 2 wind site north of the Quartzite Mountain site.
- Saddle Mountain is able to support two or three turbines. Access to this site is significantly easier.
- EPEC has operated a Class 2 site for several years. WSTF is planning to buy green credits in 2007 from EPEC.

Looking into the Future



Looking into the Future

- Working with EPEC contracting on how to handle excess power. At this time, the option of receiving credit for energy supplied to the EPEC grid is being discussed.
- Storage of excess power is the goal for the WSTF test bed.
- Integrating Solar and Wind power is being considered.

Looking into the Future

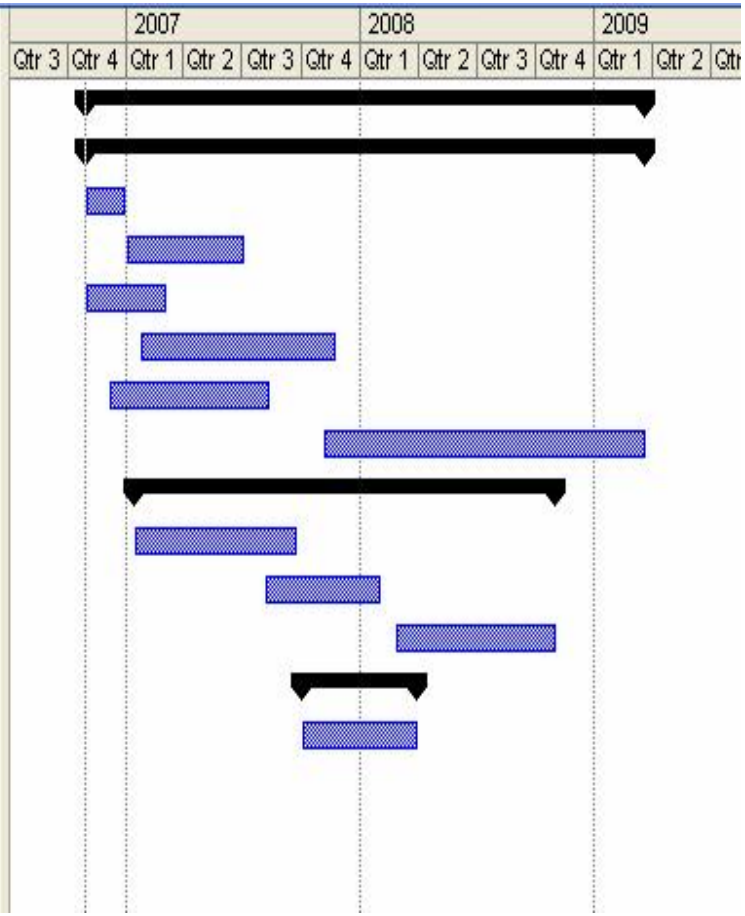
- WSTF Plan
  - Wind and Solar Power to operate Remediation System and WSTF Industrial Area (07-09)
    - Environmental Assessment
    - Design, Construction, Activation
  - Test Bed for Hydrogen Fuel Cells (07-08)
    - Form WSTF Technology Team
    - Investigate modern Hydrogen technologies
    - Evaluate and test Hydrogen technologies
  - Test Bed for Storage Technologies (08-10)

Looking into the Future

- WSTF Plan
  - Power Transfer Technology (08-09)
    - Usage of stored energy via Fly Wheel technology
  - Development of more compact renewable energy systems for remote location (as technology develops)
  - Consideration of other renewable energy sources (ongoing)
  - Automated Management and Distribution Control System for various systems (start 07)

Looking into the Future

	Task Name	Duration	Start	Finish
1	**Renewable Project from 10/31/06 Forward**	**625 days**	**Mon 10/30/06**	**Fri 3/20/0**
2	**Wind Energy**	**625 days**	**Mon 10/30/06**	**Fri 3/20/0**
3	Roadway Feasibility Study and Preliminary Des	44 days	Mon 10/30/06	Thu 12/28/0
4	Environmental Assessment	130 days	Tue 1/2/07	Mon 7/2/0
5	Pursuit of Potential Third Party Funding w/DOE	90 days	Mon 10/30/06	Fri 3/2/0
6	Roadway Construction	220 days	Mon 1/22/07	Fri 11/23/0
7	Design of Windmills and Transmission	180 days	Mon 12/4/06	Fri 8/10/0
8	Construction of Windmills and Transmission	360 days	Mon 11/5/07	Fri 3/20/0
9	**Solar Energy**	**470 days**	**Mon 1/15/07**	**Fri 10/31/0**
10	Solar Farm Design Devlopment	180 days	Mon 1/15/07	Fri 9/21/0
11	Environmental Assessment	130 days	Mon 8/6/07	Fri 2/1/0
12	Solar Farm Construction	180 days	Mon 2/25/08	Fri 10/31/0
13	**Power Storage**	**130 days**	**Mon 10/1/07**	**Fri 3/28/0**
14	Hydrogen Storage Feasibilty Study	130 days	Mon 10/1/07	Fri 3/28/0



Looking into the Future

- Three options under consideration
  - Energy Service Provider Contracts (ESPC) for combined wind and solar systems design and installation
  - Installation of wind farm by EPEC (obligation to meet green credits). Contractor that won bid for their project is looking for investors.

Looking into the Future

- WSTF manages design and construction of projects.
  - Continue to work with partners, completing designs and EAs, and working with vendors on long-lead procurements.

Looking into the Future

- Partners
  - NASA HQ (Power for Remediation, Test Bed)
  - Portuguese (Wind farm, Solar)
  - NREL (ESPC)
  - NMSU (Engineering and Science)
  - EPEC (Feasibility Studies, PUC, Growth)
  - State of New Mexico (Renewable Energy Summit)
  - DoD (Combined Projects)